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(71) Applicant: SUMITOMO RUBBER INDUSTRIES
LIMITED
Kobe-shi, Hyogo-ken (JP)

(72) Inventors:
- Ashmore, Stephen Michael
Tanworth in Arden, Warwickshire B94 5HT (GB)
- Avari, Firdos Phiroz
Acocks Green, Birmingham, B27 7JN (GB)

(74) Representative: Stewart, Charles Geoffrey
SP TYRES UK LIMITED
Technical Division
Fort Dunlop, Erdington,
Birmingham B24 9QT (GB)

(54) **Pneumatic tyre**

(57) A pneumatic radial tyre (1) comprising a carcass (6) extending around the tyre (1) from bead (7) to bead (7), sidewalls (4) and a rubber tread region (2) which has a profile when considered in transverse cross section of a new tyre terminating at the sides of the tread in inner and outer shoulder regions (5) respectively, each said shoulder region (5) having a shoulder drop (a, b), which is the distance in the radially inward direction from the point of maximum tyre diameter (M) to a shoulder point (P) at the edge of the shoulder region (5), such that when the tyre (1) is mounted on a scheduled wheel-rim and inflated to a scheduled pressure, the tread region (2) is asymmetric having its said point of maximum tyre diameter (M) offset in the axial direction of the tyre from the centre line (CL) of the tyre section in the direction of the inner shoulder (5i), and the shoulder drop (a) of the outer shoulder (5o) is greater than the shoulder drop (b) of the inner shoulder (5i) such that the tread region (2) has an asymmetrical profile, characterised by the tread region (2) having substantially constant tread gauge or thickness except at the inner shoulder (5i) which has a locally reduced tread gauge or thickness so that the inner shoulder profile is trimmed.

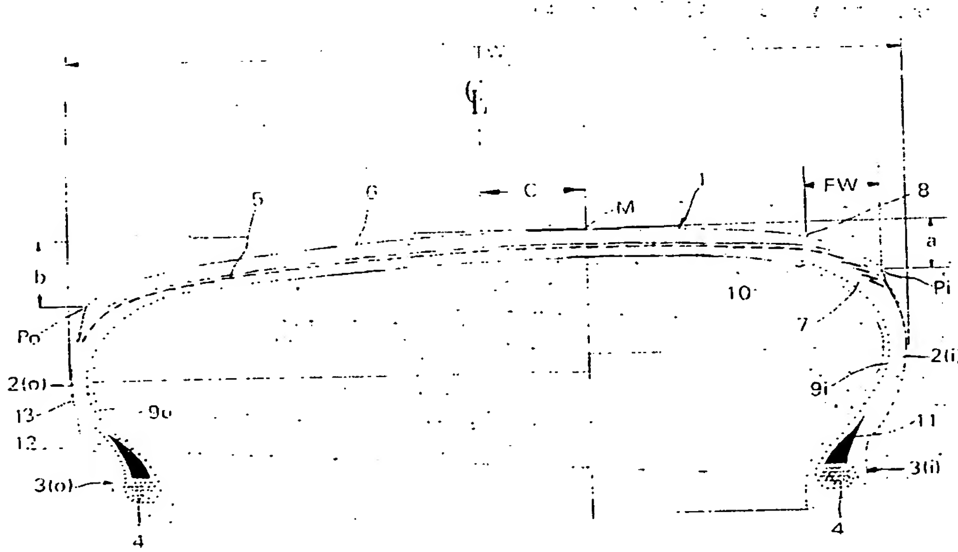

FIG. 1

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Description

This invention relates to a pneumatic tyre for passenger cars in particular to tyres for racing and similar very light performance uses.

Conventionally tyres have a symmetrical tread profile when considered in cross-section to show the curvature in the radial plane.

Proposals have been made to use different tread compounds at either side of the tyre for improved wet grip and for different tread pattern groove layouts at either side of the tread both of which provide some asymmetry. The latter also gives increased pattern density on the outside half of the tyre to improve cornering when that part of the tyre is carrying most of the cornering forces but there is a reduction in wet grip due to poorer drainage.

Conventional tyres use dual radii tread profiles. The central region of the tread has one large radius and the shoulders have a second substantially smaller radius. This is to provide a wider flatter tread with a more uniform contact patch to the road. Japanese Patent publication 3271003 proposed an asymmetrical profile shape in which the outer part of the tread of the tyre, when fitted to a vehicle, has a smaller radius than the inner part to allegedly improve wet grip.

US 4763708 proposed that the transverse sectional plane has a maximum outer diameter point spaced axially from the central plane of the tread and the radius of curvature of the narrower side is greater than the other side to improve the resistance to abrasion of the shoulder regions.

It has also been proposed to stiffen the inboard sidewall of the tyre so that more load is carried by that sidewall to offset some of the load transfer during cornering but the bulk of the material in the stiffened sidewall increases heat generation leading to durability problems.

The above tyres, however, do not optimise contact patch load distribution while cornering and thus lateral grip and handling are not optimised and uneven wear occurs. Furthermore for high cornering powers known tyres are very wide which increases cost and leads to installation problems on vehicles. Another proposal provides a pneumatic tyre having a tread region which has a profile when considered in transverse cross-section of a new tyre terminating at the sides of the tread in inner and outer shoulder regions respectively, wherein each said shoulder region has a shoulder drop, which is the distance in the radially inward direction from the point of maximum tyre diameter to a shoulder point at the edge of the shoulder region, wherein when the tyre is mounted on its scheduled rim and inflated to its scheduled pressure the tread region is asymmetric having its said point of maximum tyre diameter offset in the axial direction of the tyre from the centre line of the tyre section in the direction of the inner shoulder edge, and the shoulder drop of the outer shoulder is greater than the shoulder drop of the inner shoulder such that the tread region has an asymmetrical profile.

Such a tyre gives a substantial improvement in vehicle handling but still further improvements in handling and also in fatigue performance are desired.

Accordingly the present invention provides a pneumatic radial tyre comprising a carcass extending around the tyre from bead to bead, sidewalls and a rubber tread region which has a profile when considered in transverse cross section of a new tyre terminating at the sides of the tread in inner and outer shoulder regions respectively, each said shoulder region having a shoulder drop, which is the distance in the radially inward direction from the point of maximum tyre diameter to a shoulder point at the edge of the shoulder region, such that when the tyre is mounted on a scheduled wheelrim and inflated to a scheduled pressure, the tread region is asymmetric having its said point of maximum tyre diameter offset in the axial direction of the tyre from the centre line of the tyre section in the direction of the inner shoulder, and the shoulder drop of the outer shoulder is greater than the shoulder drop of the inner shoulder such that the tread region has an asymmetrical profile, characterised by the tread region having substantially constant tread gauge or thickness except at the inner shoulder which has a locally reduced tread gauge or thickness so that the inner shoulder profile is trimmed.

The ratio of the shoulder drop of the outer shoulder to the shoulder drop of the inner shoulder may be greater than 1.25 and preferably it is in the range of 1.25 to 5.

The region of reduced tread gauge preferably has a width measured axially of the tyre in the range of 5% to 12% of the tyre sectional width and more preferably 10%. In addition the tyre reinforcement structure may be asymmetric and this may be a asymmetric breaker construction providing greater tread reinforcement in the region of the reduced tread gauge.

The breaker reinforcement may comprise a wound strip of longitudinally reinforced breaker fabric lying at substantially 0° to the circumferential direction. The greater reinforcement in the region adjacent to the reduced tread gauge portion may be obtained by overlapping adjacent windings.

The tyre carcass may also be asymmetric and in one such construction a filler is provided in each sidewall. In a preferred construction the filler comprises aramid reinforced fabric ply which begins under the edge of the breaker, extends around the carcass and is wrapped around the bead core. The filler strip in one sidewall then has a turnup which reaches beyond the apex strip, i.e. towards the mid-sidewall region, whereas the filler strip in the sidewall which reaches to the region of reduced gauge has its filler strip terminating at the bead.

Further applications of the invention will be apparent from the following description as an embodiment of the invention by way of example only in conjunction with the attached diagrammatic drawing which comprises a

transverse cross-section of a tyre.

The tyre shown in Figure 1 is a 210/650R19 having a bead diameter of 403.1mm to suit a 19" wheelrim. The tyre comprises a tread region 1, inner and outer sidewalls 2i and 2o respectively, inner and outer bead regions 3i and 3o respectively, and bead reinforcement cords 4, one in each bead. The tyre is reinforced by a radial carcass (not shown) and a breaker reinforcement 5 which will be described later. The breaker reinforcement 5 lies beneath a tyre tread 6 of rubber compound.

By the terms inner and outer as applied herein to components or elements of the tyre is meant respectively nearer to or further away from the vehicle longitudinal centrelin when the tyre is mounted on the vehicle. The tyre is preferably provided with an indicator or other means to enable it to be mounted with the correct orientation with respect to the vehicle.

The above features of the tyre are basically the same as a conventional tyre of this size, but as can be seen from the drawing the tyre is in fact not symmetrical and has an asymmetric profile in the tread region, different length sidewalls and an asymmetric reinforcement structure, each of which will be described.

The profile of the tyre is offset in that the maximum tyre diameter MTD is located on the tread outer surface at a point M axially displaced by a distance C from the intersection with the axial centreline CL. The curvature of the tread surface to the other side of the point M is the same. Accordingly considering the inboard side of the tyre, which is the right-hand side in Figure 1, the shoulder drop a, which is defined as the distance in the radial direction between the point M on the tread surface of the maximum tyre diameter and the shoulder point Pi of the shoulder region 7, is as shown. The shoulder drop b of the outside should point Po of the tyre is measured in a similar way and can be seen to be larger than a. When considered in its inflated mounted condition the shoulder drops a and b being different provide the asymmetric construction. In the present tyre the shoulder drops are respectively: a 13mm, b 20mm Whilst the curvature of the tread to either side of the point M begins at the same value, the tread surface lying to the right of point M has a single curvature, whereas the tread surface lying to the left of the point has firstly a first curvature then two further radii. This variation of radius together with the additional width of the tyre to the left of point M generates the shoulder drop measured.

The tread profile on the inboard shoulder. i.e. the right-hand side in Figure 1, is modified by means of the thickness of the tread 6 being reduced substantially compared with the thickness across the remainder of the tyre width which thickness is substantially constant. Thus for an axial distance FW measured from the shoulder point Pi inwards of the tyre the thickness of the tread strip 6 is substantially reduced. The axial width FW is in this embodiment 10% of the total tyre width TW. It has been found that this reduced gauge region preferably has a width in the range of 5% to 12% of the total width TW of the tyre.

The breaker construction for the tyre comprises a strip winding, sometimes known as JLB or Jointless Bandage winding. of a strip of cord reinforced fabric. The reinforcement comprises an aramid cord with twelve cords per strip and the strip is 10mm wide. The reinforced strip is wound circumferentially around the tyre to provide a reinforcement ply for the breaker having aramid cords substantially at 0° to the centreline of the tread. Successive windings of the strip are positioned in edge-to-edge contact from the outside of the tyre across the centreline but in the inboard shoulder region 7 the strips are wound with an overlapping relationship to provide additional reinforcement adjacent and radially inwards of the reduced gauge region between points 8 and Pi.

As will be appreciated the tyre sidewalls 2i and 2o are of different lengths, the outboard sidewall 2o being the shorter. Both sidewalls are reinforced by an aramid cord reinforced filler strip. In the inboard sidewall 2i the aramid reinforced filler 9i extends from a point 10 under the breaker reinforcement around the tyre section to its carcass, wraps around the bead core 4 and terminates adjacent to the joint of the bead core 4 at apex strip 11. In the outboard sidewall 2o the filler strip 9i begins again under the edge of the breaker 5, extends around the bead core 4 but continues as a filler turnup 12 axially outside the bead and apex and terminates midway between the bead core and the point of maximum tyre section width 13. Thus in the outboard sidewall the filler strip provides increased reinforcement giving a sidewall having greater stiffness than the inboard sidewall.

In use of the tyre it is important that the tyre is fitted to the vehicle with the inboard and outboard sidewalls in the correct position. The region of reduced tread gauge then acts to provide in effect a trimmed shoulder which modifies the contact pressure of the tyre in heavy cornering of the vehicle. This region together with the asymmetric reinforcement provides a tyre having effectively an inner sidewall height increased by approximately 8mm. This combination with the other asymmetric features provides effectively on a vehicle a camber of 2.5° negative without needing to set the suspension and the result in high speed cornering, such as in car racing conditions. provides increased corner grip. The tyre has been found to have in addition increased fatigue life. better temperature distribution across the tread and greater consistency.

Claims

1. A pneumatic radial tyre (1) comprising a carcass (6) extending around the tyre (1) from bead (7) to bead (7), sidewalls (4) and a rubber tread region (2) which has a profile when considered in transverse cross section of a new tyr terminating at the sides of the tread in inner and outer shoulder regions (5) respec-

tively, each said shoulder region (5) having a shoulder drop (a.b). which is the distance in the radially inward direction from the point of maximum tyre diameter (M) to a shoulder point (P) at the edge of the shoulder region (5), such that when the tyre (1) is mounted on a scheduled wheelrim and inflated to a scheduled pressure, the tread region (2) is asymmetric having its said point of maximum tyre diameter (M) offset in the axial direction of the tyre from the centre line (CL) of the tyre section in the direction of the inner shoulder (5i), and the shoulder drop (a) of the outer shoulder (5o) is greater than the shoulder drop (b) of the inner shoulder (5i) such that the tread region (2) has an asymmetrical profile, characterised by the tread region (2) having substantially constant tread gauge or thickness except at the inner shoulder (5i) which has a locally reduced tread gauge or thickness so that the inner shoulder profile is trimmed.

2. A pneumatic radial tyre according to claim 1, characterised in that the region of reduced gauge has a width measured axially of the tyre in the range of 5% to 12% of the tyre section width.

3. A pneumatic radial tyre according to claim 2, characterised in that the region of reduced gauge has a width measured axially of the tyre which is 10% of the tyre section width.

4. A pneumatic radial tyre according to any one of claims 1, 2, or 3, characterised by the tyre having an asymmetric breaker reinforcement for the tread region having increased stiffness in the region adjacent to and radially inwards of the reduced gauge part of the inner shoulder (5i).

5. A pneumatic radial tyre according to claim 4, characterised in that the breaker reinforcement comprises a wound strip of longitudinally reinforced breaker fabric lying at substantially 0° to the circumferential direction and a larger number of windings per unit breaker width are provided in the region adjacent and radially inwards of the reduced gauge part.

6. A pneumatic radial tyre according to claim 4, characterised in that the breaker winding has an overlapping relationship.

7. A pneumatic radial tyre according to any one of claims 4 to 6, characterised in that the breaker reinforcement comprises aramid.

8. A pneumatic radial tyre according to any one of claims 1 to 7, characterised in that the carcass of the tyre has asymmetric reinforcement comprising in each sidewall an aramid filler which extends from the shoulder of the tyre parallel to the tyre carcass to the tyre bead region, that the filler in the sidewall on the inside of the tyre where the region of reduced tread gauge is provided terminates at its radially inward edge adjacent to the bead core and the filler in the outer tyre sidewall terminates above the tyre bead apex so as to lie between the mid-sidewall region and the bead core and provide a stiffened sidewall compared to the inner sidewall.

9. A pneumatic radial tyre according to any of claims 1 to 8 characterised in that the tyre is provided with an indicator or indication means to enable it to be mounted correctly on the vehicle such that the inner shoulder is nearer to the vehicle longitudinal centreline.

10. A vehicle having at least two tyres mounted thereon, the tyres comprising a carcass (6) extending around the tyre (1) from bead (7) to bead (7), sidewalls (4) and a rubber tread region (2) which has a profile when considered in transverse cross section of a new tyre terminating at the sides of the tread in inner and outer shoulder regions (5) respectively, each said shoulder region (5) having a shoulder drop (a,b), which is the distance in the radially inward direction from the point of maximum tyre diameter (M) to a shoulder point (P) at the edge of the shoulder region (5), such that when the tyre (1) is mounted on a scheduled wheelrim and inflated to a scheduled pressure, the tread region (2) is asymmetric having its said point of maximum tyre diameter (M) offset in the axial direction of the tyre from the centre line (CL) of the tyre section in the direction of the inner shoulder (5i), and the shoulder drop (a) of the outer shoulder (5o) is greater than the shoulder drop (b) of the inner shoulder (5i) such that the tread region (2) has an asymmetrical profile, characterised by the tread region (2) having substantially constant tread gauge or thickness except at the inner shoulder (5i) which has a locally reduced tread gauge or thickness so that the inner shoulder profile is trimmed.

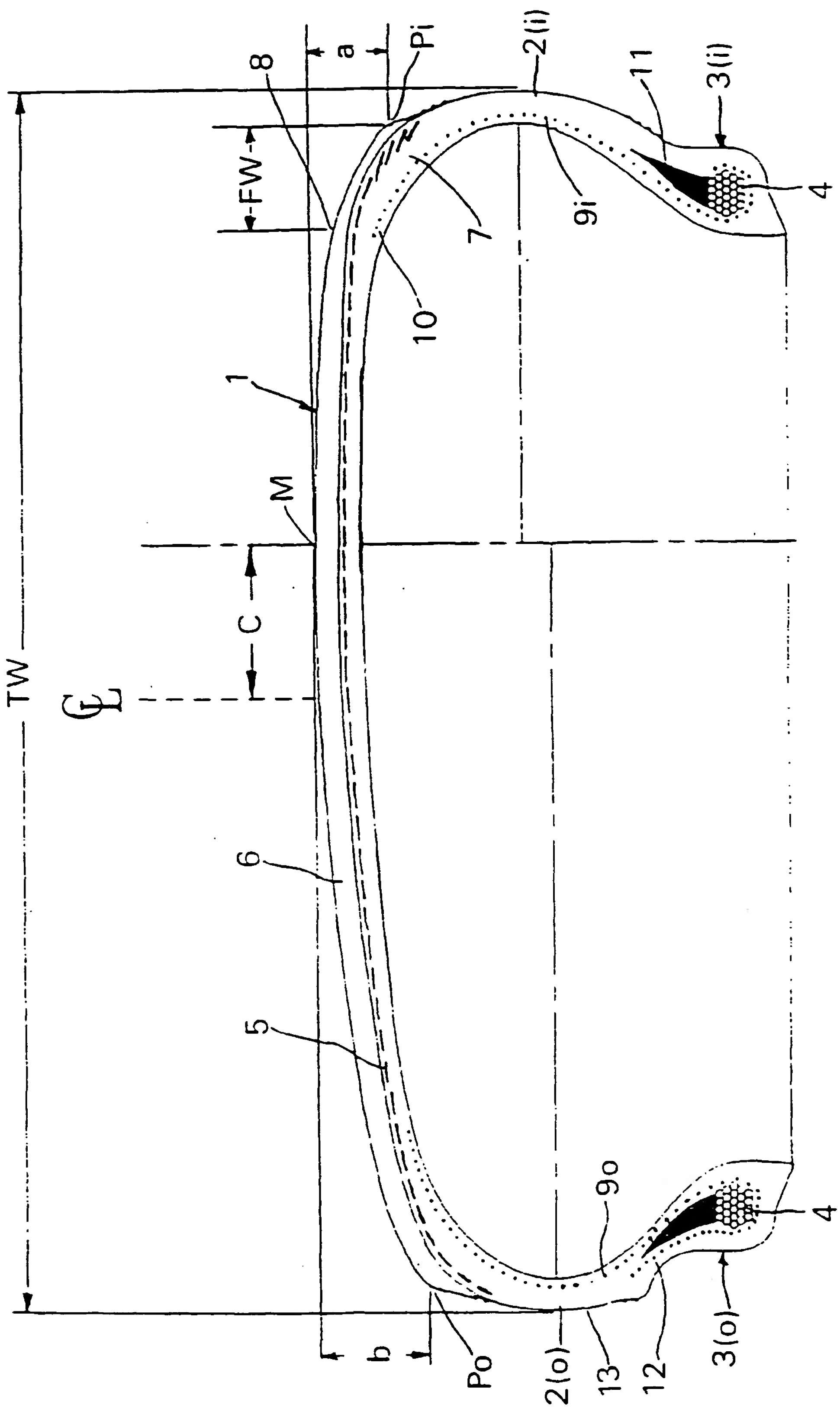

FIG.1